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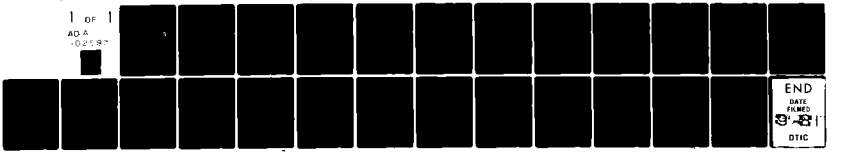

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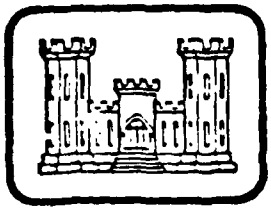

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# ENERGY CONSERVATION MEASURES AT CORPS OF ENGINEERS RECREATION AREAS

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Final Report.

Approved for public release; distribution unlimited.

Prepared by:
US Army Facilities Engineering Support Agency
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This report identifies energy conservation measures at recreation areas now being used or contemplated by the Corps of Engineers. Consumption at these sites includes energy for lighting, hot water heating, space heating, electrical hookup for campers and operation of water supply and waste water treatment facilities.

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# INTRODUCTION

## BACKGROUND

The Corps of Engineers (CE) is extensively involved in development and operation of recreation facilities. These facilities are generally located at CE reservoir projects and normally consist of a combination of sightseeing, picnicing, camping, and related facilities.

Energy conservation measures at these recreation areas should be considered within the context of recent Corps-wide emphasis on energy conservation at all levels. Consumption at recreation areas includes energy for lighting, hot water heating, space heating, electrical hookups for campers, and operation of water supply and wastewater treatment facilities.

## PURPOSE AND SCOPE

The purpose of this paper is to identify energy conservation measures at recreation areas now being used or contemplated by the Corps of Engineers and other agencies. The information described in this paper is limited to that readily available by telephone survey of the agencies involved.

# EXISTING CORPS PRACTICE

## GENERAL POLICY

General guidance for energy conservation at all Civil Works projects is given in EIL 1110-2-216. Additional guidance pertaining to evaluation of solar energy is given in ETL 1110-2-249. Other than these general documents, no centralized guidance presently exists regarding energy conservation at recreation areas.

Energy conservation measures now being taken were largely conceived and developed by CE Divisions/Districts. Such regionalized development usually results in measures better suited to local conditions. Descriptions of energy conservation measures adopted by four CE Divisions which are heavily involved in development and operation of recreation areas are described in the following paragraphs.

## SOUTH ATLANTIC DIVISION (SAD)

The SAD is considering use of solar hot water heating systems at campsite sites. Such systems would provide hot water for restroom and shower facilities which are a common feature of most CE recreation areas. The guidance in ETL 1110-2-249 requires that use of solar systems be cost

effective. SAD has been closely following this criteria. Conventional energy conservation measures being implemented by SAD include zoned heating and cooling, use of heat pumps, and issuance of permits for use of driftwood and deadwood for heating purposes.

OHIO RIVER DIVISION (ORD)

Energy conservation efforts in ORD are emphasizing retrofit of recreation area facilities with solar features and other simpler energy conservation measures. The Nashville District has been most active in utilization of solar hot water heating, with back-up electrical systems. Funding for these projects is through O&M sources, therefore, no plans and specs are prepared.

Simpler conservation measures being implemented by ORD include elimination of some hot water heating, adding insulation where possible, replacing windows with thermopane glass, using timed switches, and using flow reduction devices on showerheads.

MISSOURI RIVER DIVISION (MDR)

MRD is involved with solar hot water heating and retrofit of facilities with more conventional energy conservation features. Some consolidation of facilities (e.g., use of a single water supply or waste water treatment facility for multiple recreation areas) is being considered.

The Kansas City (KC) District is more extensively involved with energy conservation due to responsibility for military construction in a 15-state area. KC has done some R&D in this area and is beginning to compile evaluations for several projects. At the Wilson Lake recreation area, a solar hot water heating system, designed in-house by KC, has been installed and in use for about one year. This system is installed in a 4-shower/latrine facility which receives a heavy usage. A propane system serves as a supplemental source. During this past summer season, the Wilson Lake facility utilized approximately 125 gallons of supplemental propane while a similar unit with similar usage utilized 1500 gallons of propane as the single energy source. Also, there were no complaints of hot water shortage at the Wilson Lake facility. The KC District plans to use this design in future projects.

At Kannapolis Lake, a commercial solar-hot water system has been installed and performance of this system will be compared to the Wilson Lake system. The KC District has observed that solar hot water heating is suited to recreation areas because when the weather is good and the sun is shining the recreation usage increases at the same time that solar heating is most effective.

The KC District is also experimenting with Trombe Walls, installations consisting of a wall of clear-glazed material set inside of a building creating an air space. The wall is ported at top and bottom, allowing colder air to enter from the bottom, rise by convection and be heated, and exit the top. A Trombe Wall has been installed in a maintenance building with good success, achieving a temperature of 60-65° during the winter months.

A feasibility study is also underway for installation of a wind turbine at Wilson Lake. Average wind speeds at this site exceed 17 mph. The turbine would be connected to the commercial net and metered. The energy generated would then be sold to the power company, thereby reducing the energy cost of recreation area operations. The CE does not have authority to distribute electrical power, however a ruling on this policy question is now being sought.

Conventional measures for energy conservation being implemented by KC District include: adding insulation where possible, use of more energy efficient lighting, timed thermostats, use of overhead fans, carpeting on slab construction, reducing or totally closing unnecessary window and door space, closing some recreation facilities in winter, and draining waterlines in closed facilities to eliminate maintenance heating requirements.

SOUTHWEST DIVISION (SWD)

In SWD energy conservation efforts have mainly centered on transportation (vehicle usage) and the more conventional conservation measures. Electrical energy consumption has actually increased due to expanding camper hookup facilities. Solar-hot water heating systems are being used on an experimental basis but the cost-effectiveness of these installations has not been proven.

In the Little Rock District, electrical consumption for recreation areas in the first 3 quarters of FY75 was 1100 megawatt-hours. The same period in FY80 showed 1506 megawatt-hours. Little Rock has two experimental solar hot water systems in place. The more conventional energy conservation measures include: reduction of lighting, installation of more efficient lighting, closing some facilities or entire recreation areas in winter months, draining water pipes to eliminate maintenance heat, adding insulation blankets to hot water heaters, timers for lighting, and replacing full-sized vehicles used in surveillance with compacts, 3-wheeled vehicles, and in one case horses.

The Fort Worth District is considering use of heat tapes for warming pipes and eliminating all other space heat for toilet and shower facilities. Fort Worth is also distributing literature to visitors advising them of the importance of energy conservation, the only District known to be doing so.

Tulsa District is closing entire areas in the off-season, reducing surveillance, and delaying initiation of fee collections until Memorial Day, thereby conserving energy otherwise used in the gate booths.

## PRACTICE IN OTHER AGENCIES

### NATIONAL PARK SERVICE (NPS)

The NPS is currently involved in implementing new and innovative methods for energy conservation related to operation of recreation areas; however, no efforts are now being made to evaluate the relative merits of the methods on an engineering or economic basis. For example, use of gasohol in NPS vehicles was advocated, but no studies on maintenance costs, miles per gallon or total operational costs were planned. No NPS funds are available for research in this area.

The NPS energy conservation program emphasizes internal energy consumption by NPS personnel (i.e., fuel consumption of vehicles and equipment and utilities at NPS housing and other buildings). Energy costs related to recreational facilities such as hotels or concessions located on NPS land are not paid by the NPS and therefore are not being considered under the energy conservation program.

Some energy conservation measures being implemented by NPS include use of gasohol, solar collectors for hot water heating, and retrofit of existing facilities with more energy efficient features (e.g., fluorescent lighting or additional insulation).

With regard to recreation sites, particularly camping areas, the NPS has installed electric eye and timer controlled lighting for restroom facilities, hand time switches to prevent leaving lights on, timers on hot water heaters, and in some cases, permanently shutting off hot water heaters. The NPS has few recreation areas with camper hook-ups for electricity and water. But NPS personnel suggested that metering all such hook-ups and charging visitors according to usage would encourage conservation.

Waste water treatment plants at NPS sites are normally large plants serving an entire park. The Denver Service Center of NPS is involved with studies to reduce energy consumption at these plants to include evaluation of design processes for water and sewer systems, considering their energy efficiency. According to DSC rules, alternatives in design are evaluated on the basis, considering maintenance, replacement costs, [illegible] approach, for example, may result in a self [illegible] wastewater treatment facility over a conventional treatment plant. The Denver Office has also prepared an evaluation manual to [illegible] considerations in design of facilities.

## HERITAGE CONSERVATION AND RECREATION SERVICE (HCRS)

HCRS is responsible for developing a handbook for energy conservation for recreation aimed at state and local recreation agencies. This is a $60k study funded through a Department of Energy grant and awarded to the University of Michigan. The first draft of the handbook was due into HCRS on 15 September 1980. The final product will consist of a planning methodology which may be used in evaluating various energy conservation strategies or alternatives and an extensive appendix in which the level of effort, relative cost, and other data for each strategy is outlined.

HCRS plans to test the planning methodology at several workshops over a one-year period before turning the handbook over to HCRS regional personnel for field use.

## SUMMARY OF ENERGY CONSERVATION MEASURES

Energy conservation measures for recreation areas being implemented or considered by the CE and other agencies may be summarized by category as follows:

- Hot Water Heating
  - . installation of solar powered systems
  - . adding insulation blankets
  - . use of timers
  - . reduction of hot water temperature
  - . use of flow reduction devices
  - . reduction or elimination of hot water
- Space Heating
  - . adding insulation
  - . reducing thermostats
  - . use of thermopane glass
  - . reduction or elimination of window and door spaces
  - . installation of Trombe Walls for convective heating

. use of overhead fans

. draining water lines to eliminate maintenance heat requirements

. use of heat tapes in lieu of space heat for maintenance requirements

. closing of facilities in winter months

. consolidation of facilities

- Lighting

. reduction of lighting

. replacement of incandescent with fluorescent or mercury vapor with sodium vapor

. use of timed switches

- Miscellaneous

. installation of wind turbine for energy "payback"

. use of lagoons in lieu of conventional wastewater treatment for facilities

. reduction of surveillance or use of more energy efficient vehicles for surveillance

. distribution of energy conservation literature for recreation area visitors

Based on this qualitative evaluation, a summary of readily implementable energy conservation measures should be considered as a first step in reducing energy consumption at recreation areas. Such measures should require little or no capital outlay and should provide a clear cut energy savings, insuring economic feasibility. These measures include:

. closing entire facilities during periods of low demand

. consolidation of facilities where possible

. installing of timers and timed switches for lighting and hot water heating

. use of flow restrictors in taps for showerheads

- lowering thermostats for both space and hot water heating
- reduction of lighting
- distribution of energy conservation literature to recreation area visitors

More costly energy conservation measures which require significant retrofit or new construction should only be implemented after an analysis of economic feasibility. This concept is especially valid in considering solar or wind powered systems. Appropriate references for use in making such evaluations are included in the bibliography.

## CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are made regarding energy conservation measures at recreation areas:

a. The Corps of Engineers and other agencies are already significantly involved in developing and implementing energy conservation measures at recreation areas.

b. There is currently little centralized guidance for CE use, therefore most activity has been initiated at the Division/District level. This has resulted in a more regionalized approach to energy conservation.

c. Little information is available regarding energy conserved as a result of the various measures. Also, little data is currently available regarding the economic feasibility of the more elaborate energy conservation measures.

The following recommendations are made regarding energy conservation measures at recreation areas:

a. A comprehensive literature review and survey of activity should be conducted to better quantify energy conservation measures currently in use or planned for use.

b. Results of the literature survey should be summarized and made available to the CE Divisions/Districts as an information source in planning for energy conservation. This might be best disseminated in the form of an Engineer Pamphlet (EP).

c. Requests should be made to the Divisions/Districts to make summary evaluations of energy savings resulting from the simpler measures identified in this paper. Complete economic analysis for the more sophisticated measures should also be retained. Such data should be compiled for use in developing guidelines for implementation of energy conservation measures at recreation sites.

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